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Patentanmeldung Nr. Patent application No. Demande de brevet n°

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Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
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METHOD AND SYSTEM FOR PROVIDING SNA ACCESS TO TELNET 3270 AND TELNET 3270 ENHANCED SERVICES OVER WIDE AREA NETWORKS

Technical field

The present invention relates to computer networks and more particularly to a method and system for providing Systems Network Architecture (SNA) Access to Telnet 3270 (TN3270) and Telnet 3270 Enhanced (TN3270E) services over Wide Area Networks based on technologies such as Frame Relay (FR), Asynchronous Transfer Mode (ATM), Switched Multimegabit Data Services (SMDS) or Integrated Services Digital Network (ISDN).

Background art

SNA-IP

Every day, for all sorts of reasons, more and more companies are focusing on the consolidation of the multiple specialized networks they directly operate or lease from service providers onto a single protocol network. These multiple specialized networks are based on diverse networking technologies such as Systems Network Architecture (SNA), Internet Protocol (IP) or Internetwork Packet Exchange (IPX). These companies are making this consolidation one of their top priorities, they are

almost exclusively selecting IP (the Internet Protocol) as their protocol of choice. However, for the overwhelming majority of these companies that are using SNA protocols and applications, there still is and will be for the many years to come, a major requirement for employees to keep the capability they always had to have access to the huge amount of existing corporate data residing in traditional mainframes and accessible through SNA applications.

TN3270 AND TN3270 ENHANCED

In an IP environment, a widely used technique for the transport of SNA information across IP networks is the use of Telnet technologies (TN3270 and TN3270 Enhanced). This technique for SNA "green screen" workstation users is a Client/Server approach. "Host On Demand" from IBM or "WebClient" from CISCO are examples of Client software implementations. Network Utility from IBM or CISCO router's offerings are typical Server implementations (hardware and software).

The TN3270 "Client" usually runs within the customer's workstation while the "Server" is usually placed in front of the customer's Data Center mainframes (or sometimes directly within the mainframe itself) or within the customer branch offices. As illustrated in Figure 1, IP protocols (102) are used between the Server (100) and the Clients (101), while traditional SNA protocols (103) are used between the Server (100) and the target Applications (104) within the mainframe. More information concerning Telnet, TN3270, TN3270 Enhanced, Network Utility and more generally SNA over IP can be found in the following publications incorporated herewith by reference:

- "IBM 2216/Network Utility Host Channel Connection", Erol Lengerli, Jacinta Carbonell, Thomas Grueter; IBM

International Technical Support Organization, January 1999, SG24-5303-00.

- "IBM Network Utility Description and Configuration Scenarios", Tim Kearby, Peter Gayek, Gallus Schlegel, Imre Szabo, Zhi-Yong Zhang; IBM International Technical Support Organization, January 1999, SG24-5289-00.
- "Internetworking with TCP/IP - Volume I - Principles, Protocols, and Architecture" Douglas E.Comer, Second Edition, Prentice Hall 1991.
- "SNA and TCP/IP Integration", Jerzy Buczak, Karl Wozabal, Antonio Luca Castrichella, Heikki Lehikoinen, Maria Cristina Madureira, Tsutomu Masaoka, IBM International Technical Support Organization, April 1999, SG24-5291-00.
- "TCP/IP Tutorial and Technical Overview", Martin W. Murhammer, Orcun Atakan, Stefan Bretz, Larry R. Pugh, Kazunari Suzuki, David H. Wood, IBM International Technical Support Organization, October 1998, GG24-3376-05.
- Request For Comments (RFCs) from the Internet Engineering Task Force (IETF):
  - RFC 1576: TN3270 Current Practices,
  - RFC 1646: TN3270 Extensions for LU name and Printer Selection,
  - RFC 1647: TN3270 Enhancements,
  - RFC 2355: TN3270 Enhancements.

WIDE AREA NETWORKS

Data transmission is now evolving, with a specific focus on applications and by integrating a fundamental shift in the customer traffic profile. Driven by the growth of the number of intelligent (programmable) workstations, the pervasive use of local area network interconnections, the distributed processing capabilities between workstations and super computers, the new applications and the integration of various

and often conflicting structures - hierarchical versus peer to peer, wide versus local area networks, voice versus data - the data profile has become more bandwidth consuming, bursting, non-deterministic and requires more connectivity. Based on the above observations, there is a strong requirement for supporting distributed computing applications across high speed wide-area networks that can carry local area network communications, voice and data traffic (and sometimes also even video) among channel attached hosts, business or engineering workstations, terminals, and small to large file server systems. This vision of a high speed multi-protocol network is the driver for the emergence of fast packet or cell switching network architectures such as Frame Relay, Asynchronous Transfer Mode or Switched Multimegabit Data Services in which data, voice or even in some cases video information is digitally encoded, chopped into small packets and transmitted through a common set of nodes and links. In this continuously evolving environment there still is and will be for the many years to come, a major requirement for transporting "legacy" data traffic, such as System Network Architecture (SNA) traffic across Wide Area Networks.

An efficient transport of mixed traffic streams on very high speed lines means for these new network architectures, a set of strict requirements in terms of performance and resource consumption which can be summarized as follows :

- a very high throughput and a very short packet or cell processing time,
- an efficient set of flow and congestion control mechanisms,
- a very large flexibility to support a wide range of connectivity options.

More information about Wide Area Networks and more particularly about Frame Relay (FR), Asynchronous Transfer Mode (ATM) or Switched Multimegabit Data Services (SMDS) technologies can be found in the following publications incorporated herewith by reference:

- "High Speed Networking Technology: An Introductory Survey", IBM International Technical Support Organization, July 1995, GG24-3816-02.
- "Asynchronous Transfer Mode (Broadband ISDN) - Technical Overview", IBM International Technical Support Organization, June 1994, GG24-4330-00.

PROBLEMS ADDRESSED BY THE INVENTION

The TN3270 and TN3270 Enhanced (TN3270E) protocols require a full implementation of the complete TCP/IP protocols suite in TN3270 nodes. Implementing a full set of TCP/IP protocols is not only a complex task but also implies that each TN3270 node becomes a router with all the associated functions. This results in complexities and severe overhead caused by router to router protocols that are not really required just to transport SNA data.

Additionally, the cost of the nodes that participate to the TN3270 protocols is greatly impacted by:

- the amount of software to develop, distribute and maintain;
- the amount of memory and control blocks required for storing and executing the routing protocols;
- the processing capacity required for the execution of said routing protocols.

Object of the invention

It is an object of the present invention to provide simplified, comprehensive and integrated SNA access to Telnet 3270 services over Wide Area Networks such as Frame Relay (FR), Asynchronous Transfer Mode (ATM), Switched Multimegabit Data Services (SMDS) or Integrated Services Data Network (ISDN). More particularly, it is an object of the present invention to not require the Wide Area Network to provide sophisticated and costly IP protocols

It is another object of the present invention to attach SNA Client devices (Workstations) or SNA Server devices (Host attached access devices such as Telnet 3270 Servers) to a Wide Area Network (FR, ATM, SMDS, ISDN network) and to enable meaningful communication across this Wide Area Network using traditional SNA protocols. .

It is another object of the present invention to enable communication between:

- a SNA Client device attached to a Wide Area network by means of an Access Device, and
- a Telnet 3270 Server attached to this Wide Area Network,

using standard Telnet flows as if these two devices were locally adjacent (i.e attached to the same Local Area Network). From a Telnet 3270 standpoint, the Telnet 3270 Client device and the Telnet 3270 Server device appear as if these were logically interconnected via a Local Area Network.

It is another further object of the present invention to provide load balancing and more particularly to allow an Access Device to dynamically select one TN3270 Server device among a plurality of TN3270 Server devices for providing services to a SNA Client device.

It is another further object of the present invention to reduce the cost of implementing TN3270 services across a Wide Area Network, in particular by not requiring the implementation of a full TCP/IP protocol stack within the TN3270 Access Devices attaching the TN3270 Client devices to the Wide Area Network.

Summary of the invention

The present invention relates to computer networks and more particularly to a system and method in an access device for establishing a Systems Network Architecture (SNA) session between an SNA Client and an SNA application using Telnet 3270 services over a communication network , the SNA client providing Telnet 3270 client services, an access device providing access to said communication network, the communication network attaching one or a plurality of Telnet 3270 servers for accessing the SNA application. The method for use in an access device comprises the steps of:

- receiving from a Telnet 3270 client, a request for establishing a Telnet 3270 session with a Telnet 3270 Server, the request comprising an identification of the SNA client associated with the Telnet 3270 client;
- selecting a communication path within the communication network to access a Telnet 3270 server providing services to the SNA client by referring to a configuration table, the configuration table comprising for each SNA client, one or plurality of communication paths leading to one or a plurality of Telnet 3270 servers;
- forwarding the Telnet 3270 session request to a selected Telnet 3270 server along the selected communication path.

The present invention further discloses an access device comprising means adapted for carrying out the claimed method.

The present invention also discloses a network comprising at least one Telnet 3270 client and at least one Telnet 3270 server, a plurality of nodes interconnected with links and the claimed access device.

The present invention further discloses a computer readable medium comprising instructions for carrying out the claimed method.

Brief description of the drawings

The novel and inventive features believed characteristics of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objects and advantages thereof, will best be understood by reference to the following detailed description of an illustrative detailed embodiment when read in conjunction with the accompanying drawings, wherein:

- Figure 1 illustrates the various protocols (SNA, IP and TCP) involved with Telnet 3270 services.
- Figure 2 shows traditional Telnet 3270 Services across a high speed Wide Area Network.
- Figures 3 a) and b) show a physical view and a logical view of the Telnet 3270 Access Device according to the present invention.

- Figure 4 illustrates how Proxy ARP (Address Resolution Protocol) Services are provided to Telnet 3270 Clients by the Access Device according to the present invention.

- Figure 5 shows how the Access Device configuration table is built according to the present invention.

Preferred embodiment of the invention

The preferred embodiment described in the specifications uses the Frame Relay standard as Wide Area Network technology. However, a person skilled in the art can easily adapt the means and ideas described in the present application to other Wide Area Network protocols such as Asynchronous Transfer Mode (ATM), Switched Multimegabit Data Services (SMDS) or Integrated Services Digital Networks (ISDN).

EXTENSION OF NETWORKS

To remain competitive, network users extend their traditional internal SNA and IP networks outward to business partners, dealers, suppliers, and customers. In this expanding environment, users also search for ways to save money and provide connectivity between their mix of SNA and TCP/IP Server applications and their TCP/IP and SNA desktop Client population.

CONSOLIDATION OF NETWORKS

Many companies today envisage the consolidation of their WAN traffic onto a single IP-only backbone. At the same time, other companies simplify their workstation configurations and attempt to only run the TCP/IP protocol stack at the desktop. However, most of these companies still require access to SNA applications hosts.

TELNET 3270 AND TELNET 3270 ENHANCED

As shown in Figure 1, TN3270 allows end users to run IP from the desktop (101), over the network and to access an SNA host (104) through a TN3270 Server (100). The TN3270 Clients connect to the TN3270 Server using TCP connections (105). The TN3270 Server (100) provides a gateway function for the downstream TN3270 Clients (101) by mapping Client sessions (105) to SNA dependent LU-LU sessions (103) that the TN3270 Server (100) maintains with the SNA host (104). The TN3270 Server handles the conversion between the TN3270 data stream and an SNA 3270 data stream.

As mentioned above, the path from a TN3270 Client to the SNA host comprises:

1. A TCP connection over IP from the Client to the Server (105);
2. An SNA LU-LU session from the Server to the host (103);

Connecting to a host to establish an LU-LU session can be accomplished using a traditional subarea connection or using an Advanced Peer to Peer Networking (APPN) connection.

In the present application, the terms TN3270 Client and SNA Client represent the same object and will be used indifferently.

To deploy a TN3270 solution,

- TN3270 Client software (101) is installed on desktop workstations, and
- TN3270 Server software (100) is installed in one of several places discussed below.

TN3270 Client Software

Client software is available from IBM and many other vendors, and runs on top of the TCP/IP stack in the workstation. A given Client product provides one of two possible levels of standards support:

- Base TN3270 Client;
  These clients conform to RFC 1576 (TN3270 Current Practices) and/or RFC 1646 (TN3270 Extensions for LU name and Printer Selection).
- TN3270E Client
  These clients conform to RFC 1647 (TN3270 Enhancements), and RFC 2355 (TN3270 Enhancements).

A Server that can support TN3270E clients is called a TN3270E Server.

TN3270 Server Software

The TN3270 Server function (100) can be placed in a variety of products and positions within a network, including:

- in the SNA host itself;
- in a router in front of the data host or within the network or
- in a specialized box within the network;

TRADITIONAL TELNET 3270 SERVICES IN HIGH SPEED NETWORK

As illustrated in Figure 2, a typical network model providing Telnet 3270 services across a Wide Area Network comprises several SNA Client devices (running the Telnet 3270 protocols) (201) attached via IP Routers (207) to Wide Area Network nodes (204). SNA Client devices are attached to IP routers via either Local Area Networks (202) or via point to point lines (203).

The Wide Area Network (200) comprises several network nodes (204) interconnected using communication lines provided by private carriers or by public data networks service providers (208). At the far end of the Wide Area Network, the Telnet 3270 Servers (205) are attached to the SNA Hosts (206) where the SNA Applications reside.

INTERNET PROTOCOLS

The support of TN3270 and TN3270 Enhanced (TN3270E) protocols in TN3270 nodes require a full implementation of the TCP/IP protocols suite. The method and system disclosed by the present invention strictly limit the TCP/IP protocols to be implemented by the Frame Relay SNA Access Device to their bare minimum. Complex dynamic IP routing protocols such as RIP (Routing Information Protocol) or OSPF (Open Short Path First) do not need to be implemented within the Wide Area Network.

FRAME RELAY PROTOCOLS

Frame Relay is a fast packet switching technology. Because the fast packet switching operates at layer 2 of the OSI (Open Systems Interconnection) model, Frame Relay is protocol independent. Fast packet switches examine each packet and route these packets based on a common addressing technique.

Frame Relay is a connection-oriented networking technology, with Virtual Circuits (VC) defined between end-stations (Frame Relay Terminating Equipment or FRTE). The switching is done by a Frame Relay Frame Handler (FRFH). The standards for Permanent Virtual Circuits (PVCs) appear as recommendations in the ANSI and ITU-T (formerly CCITT) standards.

Frame Relay incorporates mechanisms to reach some network performance objectives, and to minimize the number of occurrences of user perceived congestion. Forward Explicit Congestion Notification (FECN) and Backward Explicit

Congestion Notification (BECN) indicators are sent through the network to inform network nodes of congested conditions. End-stations are able to prioritize their traffic by using a Discard Eligibility (DE) bit in frame headers. In case of congestion, the network first discards frames having the DE bit set. Frame Relay provides guaranteed bandwidth for each Virtual Circuit, which prevents any user from consuming all the bandwidth. At the same time, Frame Relay allows any unused bandwidth to be shared by active users. Standards concerning Committed Information Rates (CIRs) have been defined and adopted. Communication Network Management (CNM) is facilitated by a Local Management Interface (LMI) defined for User-to-Network Interface (UNI) and Network-to-Network Interface (NNI).

ASYNCHRONOUS TRANSFER MODE PROTOCOLS

The key concepts of the Asynchronous Transfer Mode (ATM) are as follows:

Cells

All information (voice, image, video, data, etc.) is transported through the network in very short (48 data bytes plus a 5-byte header) blocks called cells.

Routing

Information flow is along paths (called virtual channels) set up as a series of pointers through the network. The cell header contains an identifier that links the cell to the correct path for it to take towards its destination. Cells on a particular virtual channel always follow the same path through the network and are delivered to the destination in the same order in which they were received.

Hardware-Based Switching

ATM is designed so that simple hardware-based logic elements may be employed at each node to perform the switching. On a link of 1 Gbps a new cell arrives and a cell is transmitted every .43 msec. There is not a lot of time to decide what to do with an arriving packet.

Adaptation

At the edges of the network user data frames are broken up into cells. Continuous data streams such as voice and video are assembled into cells. At the destination side of the network the user data frames are reconstructed from the received cells and returned to the end user in the form (data frames, etc.) that they were delivered to the network. This adaptation function is considered part of the network but is a higher-layer function from the transport of cells.

Error Control

The ATM cell-switching network only checks cell headers for errors and simply discards errored cells. The adaptation function is external to the switching network and depends somewhat on the type of traffic but for data traffic it usually checks for errors in data frames received and if one is found then it discards the whole frame. At no time does the ATM network attempt to recover from errors by the retransmission of information. This function is up to the end-user devices and depends on the type of traffic being carried.

Flow Controls

An ATM network has no internal flow controls of any kind. The required processing logic is too complex to be accommodated at the speeds involved. Instead ATM has a set of input rate

controls that limit the rate of traffic delivered to the network. Other forms of input control are under discussion in various standards bodies.

Congestion Control

There is only one thing an ATM network can do when a link or node becomes congested. Cells are discarded until the problem has been relieved. Some (lower-priority) cells can be marked such that they are the first to be discarded in the case of congestion. Connection endpoints are not notified when cells are discarded. It is up to the adaptation function or higher-layer protocols to detect and recover from the loss of cells (if necessary and possible).

ACCESS TO TN3270 SERVICES ACROSS WIDE AREA NETWORKS

As shown in Figure 3 a), from a physical standpoint, the present invention discloses a method and system to provide a simplified but comprehensive access to Telnet 3270 services across Wide Area Networks. The Access Device (300) is placed between:

- the SNA Client device (301 and 302) running the standard TN3270 Client protocols, and
- the Wide Area Network (303).

The SNA Client device can be attached to the Access Device via a serial link (301) or via a Local Area Network (302). The Access Device provides minimal IP functionality to allow Telnet 3270 Servers (304) at the far end of the Wide Area Network to appear logically adjacent (in an IP terminology) to the SNA Client devices (301 and 302) attached to the Access Device (300). This minimal IP functionality simply consists in providing "proxy" ARP (Address Resolution Protocol) services.

Such "proxy" ARP services provided by the Access Device are used by SNA Client Devices to connect to the Access Device via a Local Area Network.

As shown in Figure 3 b), from a logical standpoint, the SNA Client devices (301 and 302) running the Telnet 3270 Client protocols appear directly adjacent to the Telnet 3270 Server (304) providing access to the SNA Host where SNA Applications reside (305). Of course, any number of Access Devices may be attached to the Wide Area Network. Similarly, any number of TN3270 Servers may be attached to the Wide Area Network. The role of the SNA Access Device is to intercept the Telnet session setup request message from the attached SNA Client devices. Then, based on this Telnet session setup request message, the Access Device determines the Telnet 3270 Server to which the Telnet session request message must be forwarded. The SNA Logical Unit name of the Logical Unit (LU) associated with the SNA Client device for this session is included in the Telnet session request message issued by said SNA Client device. The selected Telnet 3270 Server is one of the Telnet 3270 Servers that provide services for the Logical Unit for which the SNA Client device is initiating the Telnet session setup request message.

In a Frame Relay Wide Area Network, the Access Device determines - based on a pre-configured table (306) - the Virtual Circuit (VC) (307) to access the selected Telnet 3270 Server. Once a Telnet 3270 has been selected by the Access Device, the Telnet session request message is forwarded by the SNA Access Device to the Telnet Server over the selected Frame Relay Virtual Circuit. This Virtual Circuit provides a path between the Access Device and the Telnet 3270 Server, across the Frame Relay Wide Area Network (303).

Once the Telnet session has been established between the SNA Client device and the Telnet 3270 Server, the SNA Access

Device as well as the Wide Area Network are completely transparent. They just transport packets between the Client and the Server over the selected Virtual Circuit.

ACCESS DEVICE CONFIGURATION TABLE

As shown in Figure 5, as an initialization phase, the SNA Access Device must be configured with all the information necessary for selecting a Virtual Circuit to associate with a Telnet session. The Virtual Circuits are the communication paths from the SNA access device to the TN3270 Servers to which the Telnet session setup requests must be forwarded to. An SNA Access Device configuration table is build, based on the configuration file (308) of each of the TN3270 Servers connected to the Wide Area Network and that communicate with the SNA Client Devices attached to the Access Device. In Figure 5, three TN3270 Servers S1, S2 and S3 are shown. Each of these TN3270 Servers has a configuration file (308) (whose format is specific to the implementation of the Server) : S1 file (502), S2 file (503) and S3 file (504). The SNA Access Device is configured with all the Virtual Circuits (501) providing communication paths within the Wide Area Network between the SNA Access Device and the TN3270 Servers.
The configuration file (308) of each Telnet 3270 Server:

- comprises configuration information of the Permanent Virtual Circuits (PVCs) that the Telnet 3270 server supports for all the destinations accross the WAN. Configuration files are all processed off line to produce the SNA Access Device configuration table (500). In the example of Figure 5, a Telnet session setup request from LU1 can use either PVC **a** or PVC **b**, leading to Server S1 and S2. Similarly, a Telnet session setup request message for LU2 can use PVC **a** that leads to Server S1 and so on.

- provides the TN3270 Server's IP addresses. These IP addresses are collected and saved within the configuration file for the SNA Access Device.

- specifies a Permanent Virtual Circuit (PVC) to route the Telnet session request messages for Logical Units that are not listed explicitly in the configuration table (500). PVC **d** leads to Server S3 and corresponds to the default routing for the Logical Units that are unknown from an SNA Access Device standpoint. In this example, Server S3 processes all the Telnet session setup request messages comprising an LU name that is unknown by the SNA Access Device. This mechanism provides some form of wild card routing capabilities to the SNA Access Device.

PROXY ARP SERVICES PROVIDED BY THE SNA ACCESS DEVICE

SNA Client Devices connected to the SNA Access Device use IP protocols to communicate to their Telnet Servers in charge of providing SNA access to the target Applications. As shown in Figure 4, some SNA Client Devices (404) are connected via a Token Ring Local Area Network (LAN) (403) to the SNA Access Device (400). Other SNA Client Devices are attached via an Ethernet LAN (402) to this SNA Access Device (400). Since IP protocols are used, the very first message that an SNA Client device attached via a LAN to the SNA Access Device issues is an ARP (Address Resolution Protocol) request message.

An SNA Client device only knows the IP address of the TN3270 Server to use for a session. Over a Local Area Network, the Medium Access Control (MAC) of the box to which the traffic towards the destination Server must be determined. This is provided using ARP protocols where a request (called an ARP request) comprising the IP address of the destination is sent

over the LAN. The box in charge of routing the traffic to the destination (the destination is identified by the IP address) replies over the LAN by specifying its MAC address (the message is called an ARP response).

An ARP control message is a broadcasted message over the Local Area Network (LAN). When any of the SNA Client Devices issues an ARP request message, containing the IP address (401) of the Server that the SNA Client device wants to reach, the SNA Access Device (400) traps the ARP request, generates an ARP response that comprises the Medium Access Control (MAC) Address of the SNA Access Device over the Local Area Network (405 and 406). This tells the SNA Client Device that in order to reach the Server corresponding to the IP address comprised in the ARP request message, the MAC address of the SNA Access Device (comprised within the ARP response) has to be used as addressing information in every IP message sent over the Local Area Network.

For a link attached SNA Client Device, as there is only one device (the SNA Access Device) at the other end of the link, the SNA Client device does not need a MAC address to be associated with the destination TN3270 Server. Therefore, proxy ARP services are not required for link attached SNA Client devices.

PROCESSING A SESSION SETUP REQUEST FROM AN ATTACHED SNA CLIENT DEVICE

When an SNA Client device (301) issues a Telnet Session setup request message, the message is sent over the link (or LAN) from the SNA Client device to the SNA Access Device. This Tenet session setup request message is a TCP/IP message sent over the Telnet 3270 "well-known" port (Port "23") since it is a Telnet message.

- The source IP address in the IP header of the message received by the SNA Access Device is the IP address of the SNA Client device.
- The destination IP address is the IP address of the Telnet Server (or set of Telnet Servers) to which the Telnet session request message must be sent to.

There could be several Telnet Servers with the same IP address if these Servers can all satisfy session setup requests from the same SNA Client device (or set of SNA Client Devices). For LAN attached workstations, the SNA Access Device that previously responded to the ARP request message from the SNA Client device receives this message, as the SNA Access Device provides "proxy-ARP" services for the Telnet Server. For link attached SNA Client device, the message is also received by the SNA Access device, but proxy ARP services are not required.

Using its configuration table (306), the SNA Access Device determines the Virtual Circuit across the WAN to forward the Telnet Session request message to the selected TN3270 Server. Across the selected Virtual Circuit, the message will then get to the target Telnet 3270 Server.

EXPLOITING THE CONFIGURATION TABLES

When a Telnet Session setup request message is received by an SNA Access Device, this SNA Access Device uses the LU addressing information within the received message to search the configuration table.

- If there is only one Permanent Virtual Circuit (PVC) in the PVC list within the configuration table (500), this PVC is selected and used. This means that in this case, one TN3270 Server only can satisfy the request of the SNA Client device.

- If there are several PVC listed, a choice must be made. Similarly, in this case, this means that several TN3270 Servers can satisfy the request of the SNA Client device.

In a preferred embodiment of the invention, a simple Round Robin mechanism is used. In other words, PVCs are selected one after the other by the SNA Access Device in order to distribute the Telnet Session request messages to every Telnet 3270 Server capable to provide services for the specified SNA Client device.

Alternatively, in a more sophisticated embodiment, the SNA Access Device can regularly poll the Telnet 3270 Servers to obtain an estimation of their availability, load or both load and availability. The collected information can be used to select one Virtual Circuit among all possible ones listed in the configuration table, and to go to the "best" Telnet 3270 Server (a Telnet Server available and capable of providing session services for the requesting SNA Client device). There are typical implementations of such load balancing functionality like those provided for example by both IBM (International Business Machine) and Cisco Systems equipment providers.

ADVANTAGES

The main advantages associated to the invention may be listed as follows:

- The TN3270 Client is completely isolated from the Wide Area Network protocol specificities. The TN3270 Client is in, fact natively connected to the SNA Access Device which role is to hide the particularities of the Wide Area Network.
- From a Telnet 3270 protocol standpoint, the SNA Access Device is completely transparent. In other words, the Access

Device is not seen from either the TN3270 Server or the SNA Client device running the TN3270 Client protocols.

- SNA Client devices are standard TN3270 Client devices.
- Standard TN3270 Servers can be used.
- The support of the invention does not require any modification of the Wide Area Network protocols.
- The invention can be used for various Wide Area Network (WAN) technologies such as Frame Relay (FR), Asynchronous Transfer Mode (ATM), Switched Multimegabit Data Services (SMDS) or Integrated Services Digital Network (ISDN).

While the invention has been particularly shown and described with reference to a preferred embodiment, it will be understood that various changes in form and detail may be made therein without departing from the spirit, and scope of the invention.

Claims

1. A method for use in an access device (300) for establishing a Systems Network Architecture (SNA) session between an SNA Client and an SNA application (305) using Telnet 3270 services over a communication network (303), said SNA client providing Telnet 3270 client services (301/302), said access device (300) providing access to said communication network (303), said communication network (303) attaching one or a plurality of Telnet 3270 servers (304) for accessing said SNA application (305),
said method comprising the steps of:

- receiving from a Telnet 3270 client (301/302), a request for establishing a Telnet 3270 session with a Telnet 3270 Server (304), said request comprising an identification of the SNA client associated with the Telnet 3270 client;
- selecting a communication path (307) within the communication network to access a Telnet 3270 server (304) providing services to the SNA client by referring to a configuration table (306), said configuration table comprising for each SNA client, one or plurality of communication paths (307) leading to one or a plurality of Telnet 3270 servers (304);
- forwarding the Telnet 3270 session request to a selected Telnet 3270 server along the selected communication path.

2. The method according to the preceding claim comprising the further step of:

- routing traffic associated with the established Telnet 3270 session to the selected Telnet 3270 server along the selected communication path.

3. The method according to any one of the preceding claims wherein said step of selecting a communication path (307) within the communication network comprises the further step of:

- selecting one Telnet 3270 server among the plurality of Telnet 3270 servers associated with the SNA client, according to some performance, availability and load balancing criteria.

4. The method according to any one of the preceding claims wherein SNA client and access device (400) are attached on a Local Area Network, and wherein said step of receiving a request for establishing a Telnet 3270 session is preceded by the step of:

- receiving on a Local Area Network (LAN), an Address Resolution Protocol (ARP) request, said ARP request comprising the Internet Protocol (IP) address of the Telnet 3270 server the SNA client (404) wants to access;
- sending an ARP response to the SNA client (404), said ARP response comprising the Medium Access Control (MAC) address (405, 406) of the access device (400) over the Local Area Network (LAN) (402, 403).

5. The method according to any one of the preceding claims comprising the preliminary step of :

- defining said configuration table (306) with, for each SNA client:
  - an identification of the SNA client, more particularly a SNA Logical Unit (LU) name;

- one or plurality of communication paths (307) from the access device to the one or a plurality of Telnet 3270 servers (304);
- an identification of each Telnet 3270 server (304), more particularly an Internet Protocol (IP) address.

6. The method according to any one of the preceding claims wherein said step of defining said configuration table comprises the further step of:

- specifying a communication path (307) by default, to access a Telnet 3270 server (304) for SNA clients not identified the configuration table (306).

7. The method according to any one of the preceding claims wherein each Telnet 3270 server comprises a configuration file (308) comprising:

- a list of SNA clients for which the Telnet 3270 server (304) provides services;
- for each of said SNA clients, a communication path (307) within the communication network (303) between the access device (300) and said Telnet 3270 server (304).

and wherein said step of defining a configuration table (306) comprises the further step of:

- retrieving and consolidating the one or plurality of configuration files (308) in a single configuration table (306) locally stored within the access device (300).

8. The method according to any one of the preceding claims wherein:

- a SNA client is identified by a SNA Logical Unit (LU) name; and
- said Telnet 3270 session request comprises the SNA Logical Unit (LU) name of the SNA client associated with the Telnet 3270 client (301/302).

9. The method according to any one of the preceding claims wherein said communication paths are Permanent Virtual Circuits (PVCs).

10. The method according to any one of the preceding claims wherein the access device (300) attaches one or a plurality of SNA clients (301/302) by means of serial links (301) or/and Local Area Networks (LAN) (302).

11. The method according to any one of the preceding claims wherein said communication network (303) is a Wide Area Network (WAN) based on a networking technology such as Frame Relay (FR), Asynchronous Transfer Mode (ATM), Switched Multimegabit Data Services (SMDS) or Integrated Services Digital Network (ISDN).

12. An access device (300) comprising means adapted for carrying out the method according to any one of the preceding claims.

13. A network comprising at least one Telnet 3270 client (302) and at least one Telnet 3270 server (304), a plurality of nodes interconnected with links and an access device (300) according to claim 12.

14. A computer readable medium comprising instructions for carrying out the method according to any one of claims 1 to 11.

METHOD AND SYSTEM FOR PROVIDING SNA ACCESS TO TELNET 3270 AND TELNET 3270 ENHANCED SERVICES OVER WIDE AREA NETWORKS

Abstract

The present invention relates to computer networks and more particularly to a system and method in an access device (300) for establishing a Systems Network Architecture (SNA) session between an SNA Client and an SNA application (305) using Telnet 3270 services over a communication network (303), the SNA client providing Telnet 3270 client services (301/302), an access device (300) providing access to said communication network (303), the communication network (303) attaching one or a plurality of Telnet 3270 servers (304) for accessing the SNA application (305). The method for use in an access device (300) comprises the steps of:

- receiving from a Telnet 3270 client (301/302), a request for establishing a Telnet 3270 session with a Telnet 3270 Server (304), the request comprising an identification of the SNA client associated with the Telnet 3270 client;
- selecting a communication path (307) within the communication network to access a Telnet 3270 server (304) providing services to the SNA client by referring to a configuration table (306), the configuration table comprising for each SNA client, one or plurality of communication paths (307) leading to one or a plurality of Telnet 3270 servers (304);
- forwarding the Telnet 3270 session request to a selected Telnet 3270 server along the selected communication path.

Figure 3

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Protocols Involved with TN3270 Services

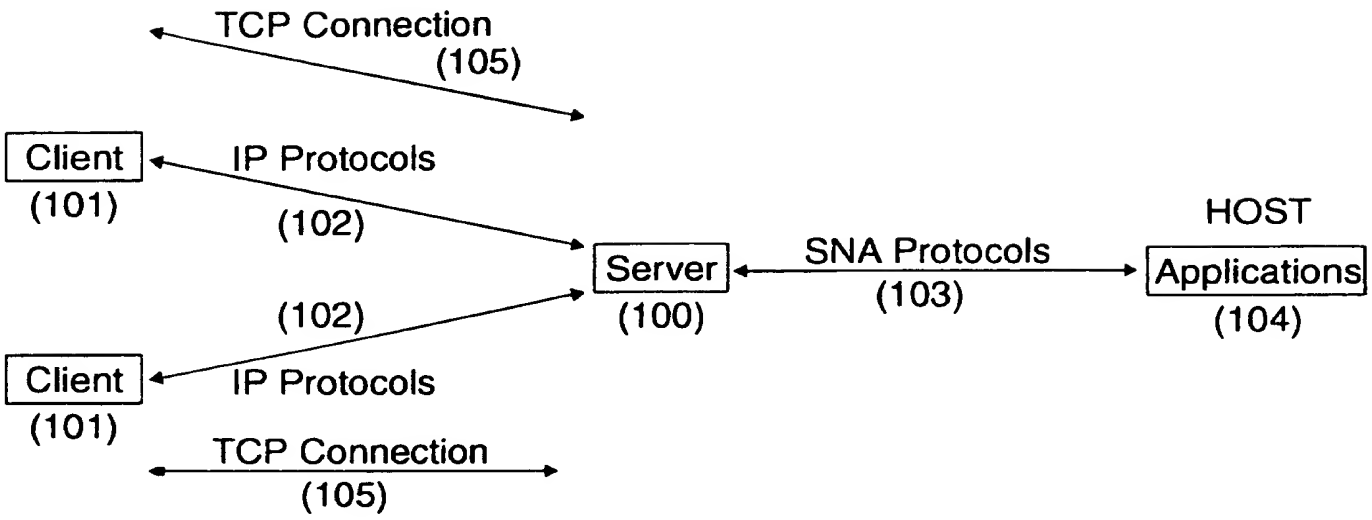


FIG. 1

TN3270 Services in High Speed Wide Area Network

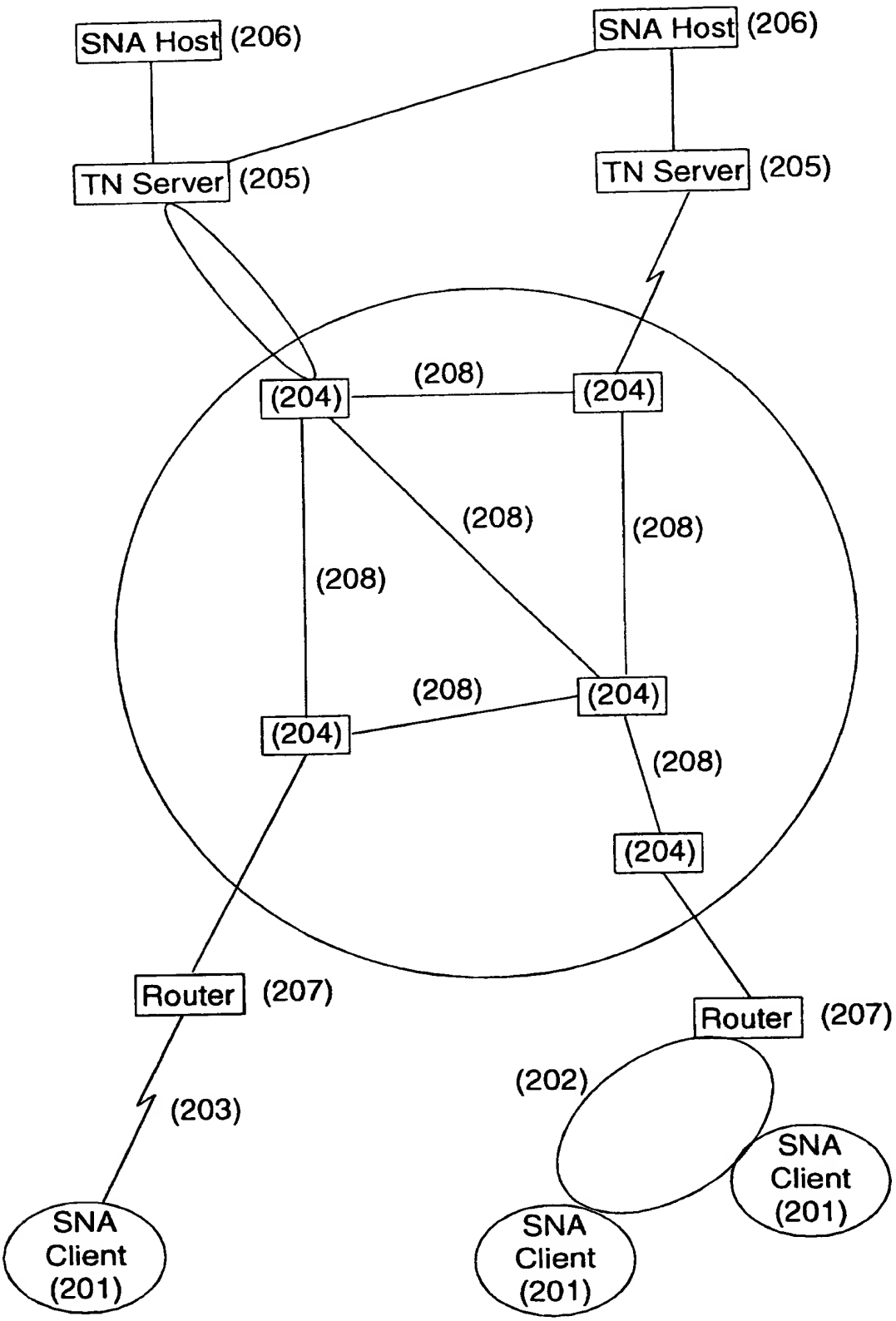
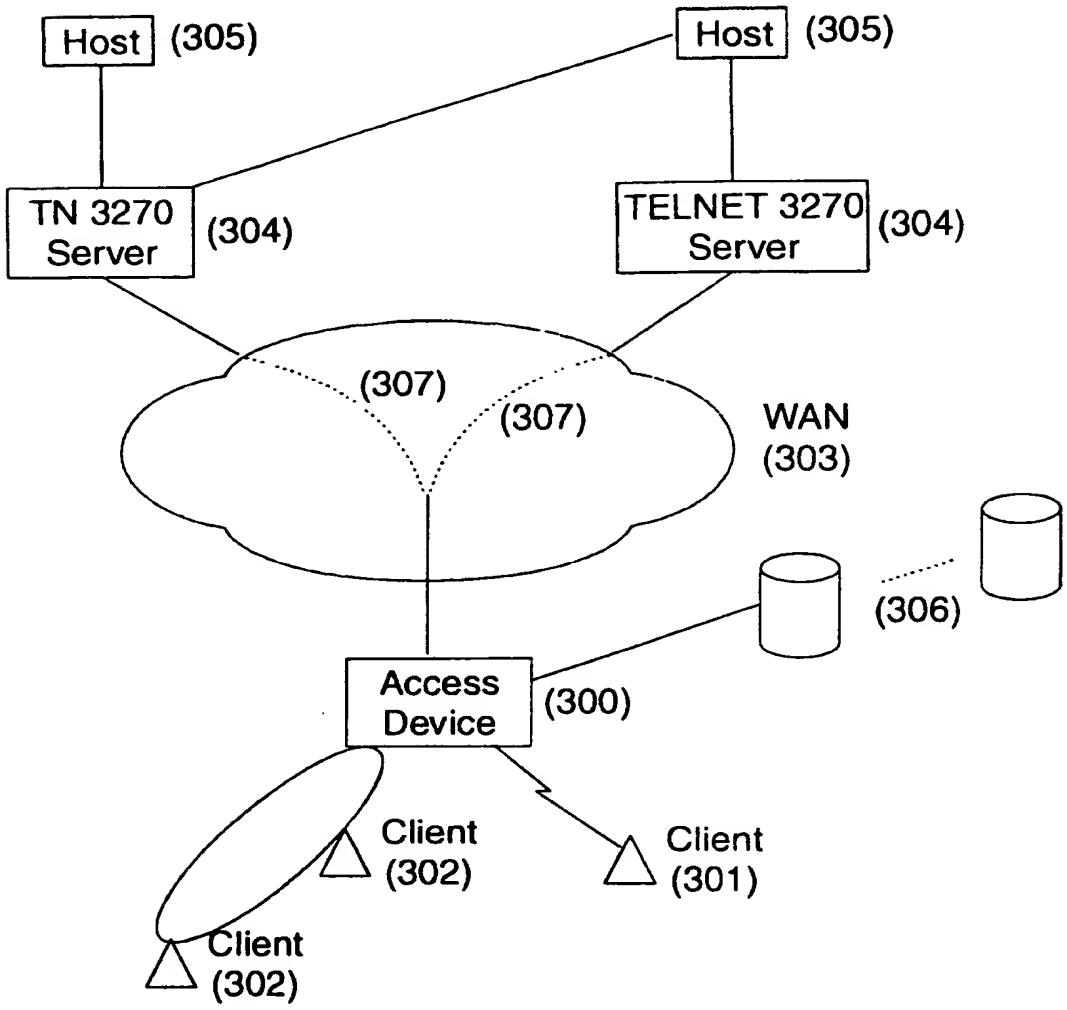


FIG. 2

TN3270 Wide Area Network Access Device

a) Physical View



b) Logical View

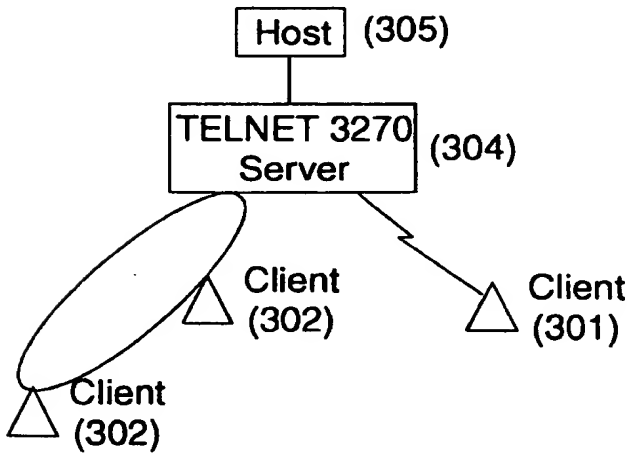


FIG. 3

Access Device Proxy ARP Services

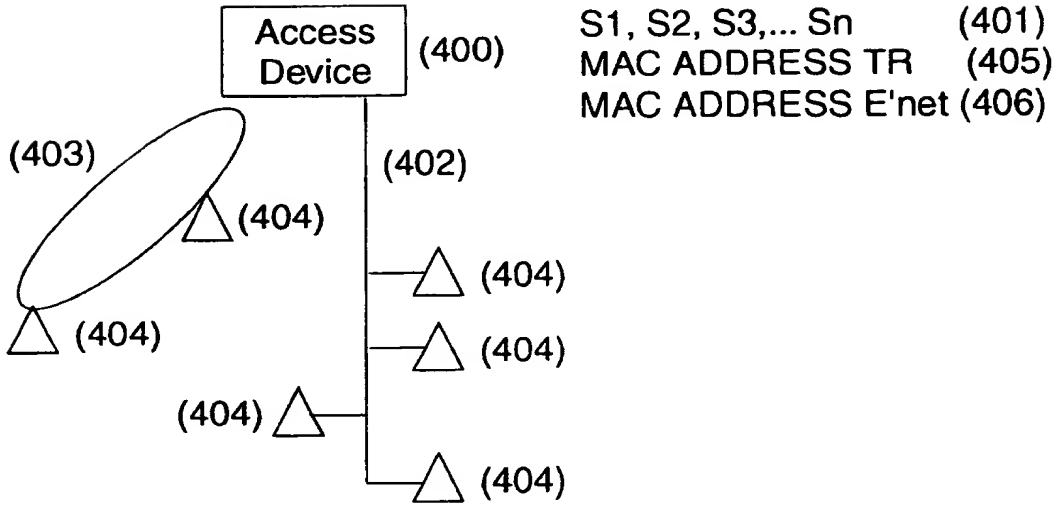


FIG. 4

Access Device Configuration Tables

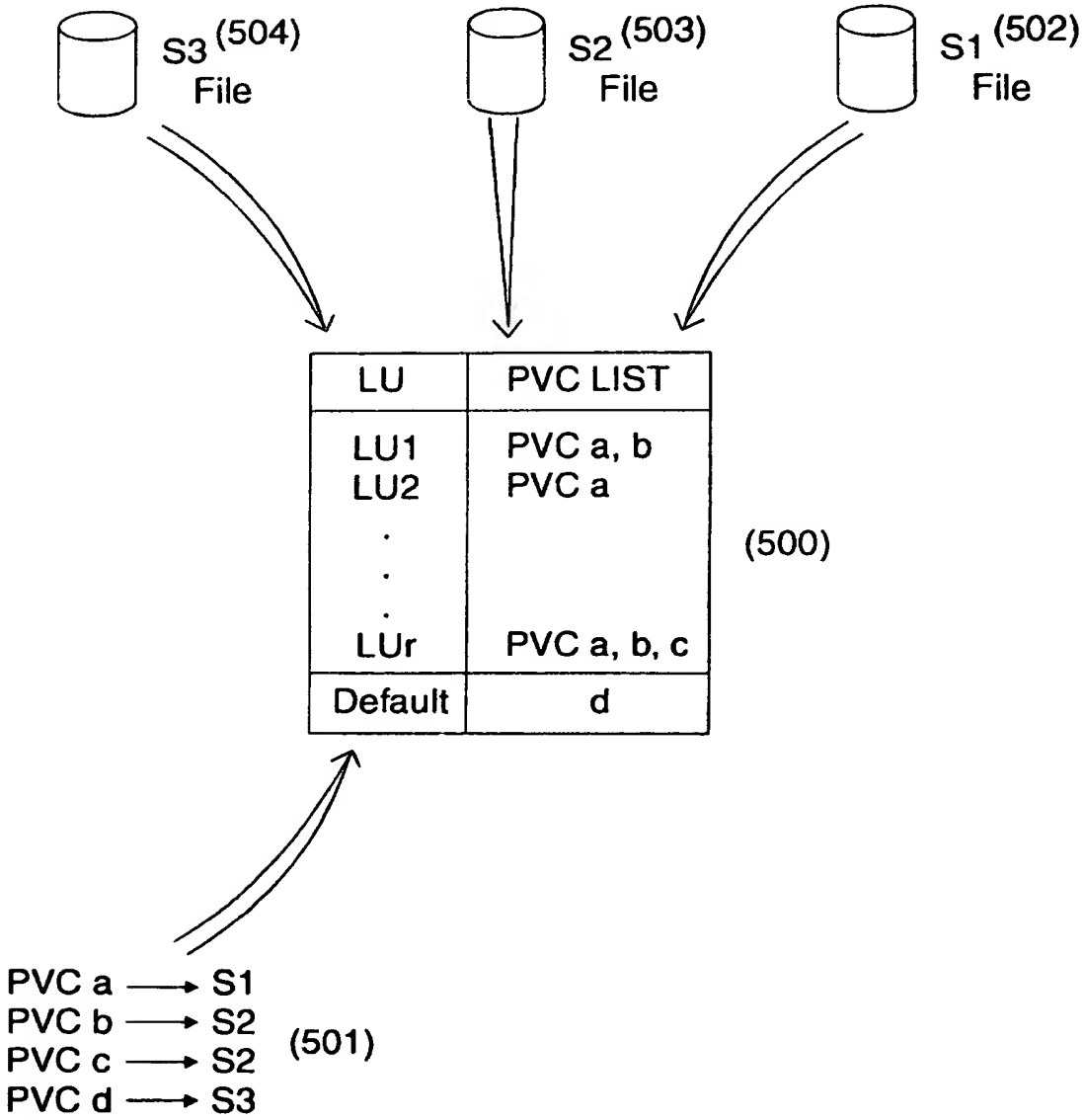


FIG. 5